Paper 1

GEOPOLYMER RESEARCH IN INDIA FOR SUSTAINABLE GREEN TECHNOLOGY

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ABSTRACT

It is widely accepted that geopolymer binders and concretes would be ushering in an era of real green construction technology as low CO_2 footprint based substitute for ordinary portland cement. There are two main constituents of geopolymers, namely the source materials and the alkaline liquids. The source materials should be rich in silicon and aluminium namely naturally occurring minerals like kaolinite, clays etc. Alternatively, it can be by-product materials such as fly ash, slag, silica fume, meta kaolin, rice husk ash, red mud etc. The choice depends on availability, cost and type of application. The alkali liquids are from soluble alkali metals that are usually sodium or potassium based. The most common alkaline liquid used in geoploymerization is a combination of NaOH or KOH and Na_2SiO_3 or K_2SiO_3. In India, CSIR- National Metallurgical Laboratory started a comprehensive programme on fly ash (a by-product of Thermal power plant) based geopolymers encompassing both basic and applied aspects of geopolymerisation. After several laboratory experimentation, a number of novel geopolymer based building and construction materials have been developed by CSIR-NML. The process flow sheet developed at lab scale consists of mixing fly ash, milled granulated blast furnace slag (a by-product of Iron and steel plant), sand and aggregate with alkali solution, vibro compaction into desired shapes using PVC mould and curing at $27^{O}C$ in controlled condition for different periods. The paper discusses the scientific aspects of this laboratory development and process modification done during up-scaling of the technology in a fully automated pilot plant. The paper also highlighted the African connections with CSIR-NML regarding geopolymer research under CV Raman and CSIR-TWAS scholarship programme. Other Indian academic and research institutions are also engaged in geopolymer research with different kinds of source materials and alkaline activator. The paper briefly reviews the same.